

and the bottom plies are manufactured the conventional way using standard Head Boxes 200 to manufacture the top and bottom web layers. The manufactured two web layers are then glued together with a spray unit 20 just before the webs get together between the roller 203 and wire 2011. After that another spray unit 20 adds i.e. a white mineral layer on top of the combined sheet preparing the sheet for further treatments like coating.

Fig. 14 comprises of exemplary spray units 20 first (from left to right) sizing the paper web in a two sided sizing and then finishing it by two sided coating. The infrared dryer units 10 are followed each spray unit to solidify the sprayed material onto the surface. Roller 101 turns the web for sizing/treating facing the other side before drying on cylinders 100. The rollers 202 turn the sheet for coating facing the other side before final drying on the drying cylinders 100.

Fig. 15 comprises of exemplary spray units 20 first used in the machine basement if there is no possibilities to install the units on the dryer section itself. The floors of the building are marked as 2000. The system can be built a myriad of ways on existing and new paper machines based on concepts shown in Figures 1, 2 and 3 and each case has to be assessed separately.

CLAIMS

Claim 1: Apparatus and method to make paper and board by spraying fibrous and other raw materials and chemicals, where the spray direction is essentially downwards onto a moving wire or a nip, formed by a pair of wires, or a wire and a roller, or already formed fiber web and a wire or a roller, using gas propelled or other individually adjustable nozzles that are attached inside a gas flow balanced box, mechanically or dynamically sealed to prevent potentially forming aerosols from escaping, a box that contains one or several controllable rows of these spray nozzles that also can control the humidity conditions inside the box, and from which the excess gases are removed in a regulated way in proximity and generally parallel to the wall that holds the individual spray nozzles.

Claim 2: Apparatus in Claim 1 consisting of one or several generally similar spray box units to independently spray paper manufacturing fibers, fillers, chemicals, fragrances, pre-coatings, and barrier- and other coatings onto paper and board webs, or nips formed by paper webs during their manufacturing processes, or afterwards in a separate process step.

Claim 3: Apparatus in Claim 1 including a non-metering doctoring device, that can include such equipment as a non-metering bent or rigid doctor blade, rigid gap blade, air blade, hot or cold gas blade or condensing steam blade, and controllable gap hydroplaning roller or

ordinary roller followed by a non-metering doctoring device, and where the system can include such backing devices like rollers, airless and air aided tables, and wire support with or without vacuum assistance.

Claim 4: Apparatus in Claim 1 where 40 to 80 degrees C spray environment is used for sizing chemicals.

Claim 5: Apparatus in Claim 3 where a roller can be used both as a roller and a hydroplaning roller and where the surface temperature of this roller is controlled by using cooling and heating as required by the process.

Claim 6: Apparatus in Claim 3 where ultrasonic water mist is used for moistening the doctoring devices or the spray box interior area.

Claim 7: Apparatus in Claim 1 where the humidity inside the spray box is controlled by temperature regulated liquid addition into the motive gas line of the nozzles, and where additional adjustments are made using excess gas extraction system that can prevent air from entering the spray box, or from escaping it carrying along potentially harmful aerosols to the environment.

Claim 8: Apparatus in Claim 1 connected to an air cleaning device including a cyclone based air washer from which the wash water can be reused as make-up dilution to the sprayed chemicals or materials, and where the moist air cleaned from spray material and aerosols before release to the atmosphere.

Claim 9: Apparatus in Claim 1 where the material to be sprayed is received from the pressure controlled main distribution line that can include internal fluidizer, into individual nozzle lines through a specific restrictor or orifice, and where the individual nozzle line pressure is measured after the restrictor or orifice, and where a positioning step-motor controls the liquid valve leading to each nozzle.